

FACILITIES MAINTENANCE AND ENGINEERING PROCEDURE		
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## 1.0 PURPOSE

The purpose of this Procedure is to define and standardize the requirements for preparation, approval, and control of the Work Order (WO) budget and cost estimates. The WO baseline budgets are a result of the Conceptual, Fiscal and Change Order pricing estimates that are submitted to the NCI for approval.

## 2.0 GENERAL

This procedure is a general guideline and is written for the Project Controls department to standardize the estimating process (Exhibit A) between the various FME Directorate Support Project Teams.

### 2.1 Estimating Guidance and requirements.

- a. The Estimating Procedure provides guidance that should be maintained for the preparation of cost estimates; unless specific information is available that provides more accurate material, labor rates, or costs.
- b. The source of the cost or rate information should be shown for all items, to assure traceability to the original source.
- c. A standard Estimate Signature and Coversheet (Exhibit C) will be used for all estimates in order to convey the project requirements and approvals.

### 2.2 Types of Estimates

(a) **Conceptual estimate (CE)** is a Rough Order of Magnitude (ROM) estimate based on parametric methods of estimating. This estimate is prepared for work orders that require design prior to its development. It is the quickest type of estimate and has an accuracy of +/- 30% (see Exhibit B). Approval of this estimate by NCI determines the "Go" or "No Go" status of the work order and authorizes the commencement of detail design.

Typical information required for this kind of estimate is:

- General scope of work
- General site/building conditions and location
- Objective project schedule, with requestor input
- Other data helpful in comparing to similar work
- Identify if in-house or out-sourced effort
- Identify required waivers
- Assumptions or exclusions to the Statement of Work (SOW)

(b) **Preliminary estimate** is an internal estimate used for large or more complex jobs during the design process in order to better define the current project scope and cost. It provides a detailed engineering estimate and a ROM estimate for Procurement and Construction. The effort is concentrated on the scope and pricing of major materials and major cost drivers. Changes between the Conceptual Estimate (CE) and the Preliminary Estimate (PE) will be communicated to NCI through the trend process. This estimate is prepared when design is approximately 15% complete and has an accuracy of +/- 20% (see Exhibit B).

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Typical information required for this kind of estimate is:

- Process description if applicable
- Preliminary process flow diagram and/or space programming
- Preliminary utilities summary and requirements
- Informal vendor quotes
- Objective & design milestone schedule
- Building renovation feasibility study
- Vendor/contractor schedule and availability

(c) **Fiscal Estimate** – A detailed estimate that is based on completed detail design documentation. Fiscal Approval of estimate by the NCI authorizes the solicitation of a construction contractor and/or the commencement of construction by the shops. The accuracy of this estimate is +/- 10% (see Exhibit B). Shop jobs that do not require engineering support are only required to have a shop estimate for fiscal approval.

Typical information required for this kind of estimate is:

- Complete design
- Design specifications
- P&IDs
- Informal vendor quotes
- Major equipment list
- Construction schedule
- Site/Building Survey and renovation (if applicable)

(d) **Shop Estimate** – A type of fiscal estimate, it is a detailed cost estimate for work to be performed in house by the shop craft labor. When a new work order is identified as being a shop job, the responsible shop foremen participate in a job walkdown to assess the scope of work requested by the customer. The foremen estimate the direct labor and material costs for the work taking into account any work that will need to be coordinated with other shops. The shop foreman estimates are prepared and documented on the Shop Estimate Input forms (see Exhibit H)

Typical information required for this kind of estimate is:

- Complete design or Scope of Work
- Jobhour labor requirements and breakout
- Documented customer requests or requirements
- Bill of Material (BOM) list
- Material pricing based on historical information
- Required shops identified to support work
- Schedule requirements

## 2.3 Basis of Estimate

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A clear and concise Scope of Work (SOW) is necessary for the development of any estimate. Well defined and documented basis and assumptions are essential for every type of estimate. Documented assumptions allow for the tracking and monitoring of changes as they occur during the development of the design. These assumptions are a critical element of the Trend/Work Order change management program. A schedule developed at the appropriate level of detail for the type of estimate is also required to ensure that staffing and escalation issues are captured in the estimate. Cost estimates are developed using the following sources of information:

- Actual historical rates experienced by FME at NCI-Frederick with adjustment to current date cost
- Crew size of construction activities
- Commercially available estimating parameters (e.g. CostLink, R. S. Means, etc.)
- Schedule and coordination of user operations

Exhibit B illustrates and summarizes the differences for comparison of these different estimates.

#### 2.4 Responsibilities

(a) **FME Director** is responsible to review Work Order estimates above \$100,000

(b) **FME Manager of Projects** is responsible to review all Work Order estimates above \$25,000

(c) **Directorate/Division Customer (DC)** is responsible to approve the work scope for all estimates greater than \$5,000. The DC also ensures that adequate funding is available to complete the work order scope or for changes requiring Contract Officer Approval (COA).

(d) **Project Controls Manager (PCM)** is responsible to review all Work Order estimates and,

- Oversee the estimating process and proper execution of this procedure.
- Review and approve all Work Order estimates that are less than \$5,000 or 10% of the original subcontract amount.
- Review and confirm the cost accuracy of the work order estimate.
- Approve the basis of estimates and underlying assumptions

(e) **Project Manager (PM)** has responsibility and authority for all estimates within their directorate.

- The Lead Engineer and Renovation Crew (RC) Lead, are responsible to coordinate major WO Estimates and Fiscal Proposals by providing scope definition and material quantity takeoffs.
- Provide the scope of work (SOW) in accordance with FME procedure FMEP-P-210.
- Review and accept Work Order estimates submitted by subcontractors.
- Review, recommend, and present the estimate to the Director and to the customer.
- During the Conceptual Estimating (CE) stage, determine if a Preliminary Estimate (PE) is required based on the size and complexity of the project.

(f) **Manager of Engineering** is responsible to:

- Provide design and engineering assistance.
- Assist in the development of the Work Order scope
- Review and confirm the technical accuracy of the scope for the cost estimate.

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- Review, and present the scope, hours and cost for Engineering
- During the Conceptual Estimating (CE) stage, determine if a Preliminary Estimate (PE) is required based on the size and complexity of the project.

(g) **Shop Foreman** for shop related work is responsible to:

- Participate in pre-work “walk-down” to meet with the customer
- Document the Scope of Work (SOW) to be performed as discussed with the customer
- Estimate the basic labor and materials required to perform shop job
- Submit/enter estimates into standard input forms (Exhibit H) to support the preparation of the fiscal package

(h) **Estimator** is responsible to:

- Evaluate that the scope available is sufficient to complete the desired type of estimate (conceptual, preliminary, or fiscal estimates)
- Prepare the estimate in accordance with historical FME estimating data or commercially available estimating standards.
- Provide pricing information, standardization of estimates, and review/checking of estimates prepared by others.
- Assist with shop estimates as an estimate checker.
- Attend selected shop jobs on an as needed basis and/or requested by the shop foremen.
- Coordinate with the Construction Contracts (CC) Department for outsourced pricing and estimates
- Provide, as required, an independent estimate for CC to verify bids from subcontractors.
- Provide and document the basis of estimate and underlying assumptions
- Maintain an Estimating log that reflects the current status and actions for each estimate.

(i) **Trend Engineer** is responsible to:

- Manage and implement the trend process to document changes identified in revisions to estimates
- Coordinate with the DST PMs to obtain trend scope for each trend
- Prepare the trend estimate, trend notice, and tracking project trends
- Record cost data into the FME database (square foot costs, costs by CSI division, etc.)
- Provide feedback to DST team

(j) **Construction Contracts** provides cost pricing or cost estimates provided by A&E, Construction, or other outside vendors to the Estimator for inclusion or support of estimates.

(k) **Manager of Operations and Maintenance** is responsible for the preparation, review and presentation of Shop Estimates. The O&M Manager or designee is responsible to evaluate new work orders and determine the lead shop and supporting shops that are required to participate in the job walkdowns and estimate preparation.

## 2.5 Definitions

(a) **A&E Costs** – Costs for a subcontract A&E to perform all or part of the engineering design and engineering support to construction

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(b) **Contract Costs** will include all costs expected from a subcontractor in a format of the separate divisions according to the Construction Specifications Institute (CSI):

1. **Construction Direct Costs** – Labor and material costs that do not include Profit or overhead. Labor costs include wages and fringe benefits. Material costs are those that are purchased by the contractor.

2. **General Conditions** – A percentage factor applied to Contractor estimates to account for the nature of the project and the work process. These can include a wide variety of items, including site access restriction or work on upper floors of a building. They should be applied to FME estimates to account for non-standard working conditions.

3. **General Requirements (Overhead)** – A percentage factor applied to Contractor estimated direct costs to cover their cost of doing business or an itemized estimate.

4. **Profit** – A percentage factor applied to Contractor estimates.

(c) **Contract Officer Approval (COA)** – COA is required for a contract modification when the amount of that modification to a particular subcontract exceeds either \$5,000 or the cumulative amount of all modifications exceed 10% of the original subcontract amount. Any modification to an approved subcontract that will cause the subcontract amount to exceed the MSR ceiling for the project shall also be submitted for COA.

(d) **Estimate Accuracy** – The accuracy of an estimate is dependent upon the amount of scope and design information available (Exhibit B). The Conceptual Estimate is prepared prior to the commencement of design and has an accuracy of +/- 30%. The Preliminary Estimate is prepared after the design is 15% completed and has an accuracy of +/- 20%. The Detailed (Fiscal) Estimate is prepared when the design is completed and has an accuracy of +/- 10%. The classification of estimates and how the changes in known scope and design affect the accuracy of the estimates are shown in Exhibit F.

(e) **Escalation Cost** – The factor applied to labor and material on longer duration projects to account for the cost increases that may occur during the course of the project. A separate factor should be applied to material and labor. It can also be a factor applied to older pricing data to bring it up to current pricing standards. The factor is generally applied as a percentage and is based on current cost data.

(f) **Estimating Factors** – The use of NCI-Frederick experience or commercially available standards, such as Means, to provide labor and material rates when there is insufficient scope definition may be used. These factors will be used for ROM estimates.

(g) **Management Reserve** is an amount included and approved in the Work Order to cover the cost uncertainty corresponding to the level of detail in the scope definition available as a project progresses. It can be reduced as uncertainties in the final scope are reduced. The management reserve will be estimated for the conceptual, preliminary, and fiscal estimates at 30%, 20%, and 10% respectively according to the uncertainty of each estimate. The use of the management reserve will be concurred by the FME Director or designee and approved by the Directorate Customer.

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(h) **Non-Cost Items** – Material or services obtained from various sources that the project will not have to pay for. In general, this will be material obtained from other site locations or from “Property”. These costs, to the extent known, are shown on the estimate summary “below the line” (excluded from the project cost). They can consist of GFE (Government Furnished Equipment), or customer furnished equipment that is purchased directly by the facility. It could also include services provided under the Interagency agreement

(i) **Planned Work Order (WO)** requires Conceptual and Fiscal estimates and Contracting Officer Approval (COA). This WO requires an estimate and schedule and must go through the approval process prior to execution.

(j) **Purchased Material Costs** – Cost of material that is purchased directly by FME and may be installed by the FME Shops or the Construction Contractor.

(k) **Scope of Work (SOW)** – Issued in accordance with FME Procedure FMEP-P-210, this document identifies the scope of the project in sufficient detail that a cost estimate can be performed. A well-defined SOW is essential to support the estimating process and trend/Work Order Change program.

(l) **Special Assist Work Order** – Any Work Order which requires minimal shop support and is estimated to cost less than \$5,000. This is a type of Unplanned Work Order.

(m) **Trends** are used to track and identify scope changes and project evolution in a timely fashion. A trend estimate should be as detailed as possible. It is essential to identify the scope of work and justification for the change as early as possible in order to estimate and track it effectively. Trends are prepared in accordance with the Trend Procedure FMEP-G-0120.

(n) **Unplanned Work Order** does not requires Conceptual or Fiscal estimates nor Contracting Officer Approval (COA). Typically, requires only shop action or a special assist action. Examples of this type are:

- Trouble calls
- Special assists (Work Orders with a value of less than \$5,000)
- Planned WOs changed to Special Assist

## 2.6 Estimate Process Definitions

### (a) Conceptual Estimate (CE)

1. Prepared prior to the execution of the project, it is a rough order of magnitude of the scope, cost and schedule. It is based on preliminary scope information and conceptual cost data. The conceptual estimate is the basis to determine the “Go or No Go” status of the work order.
2. Should include a listing of assumptions and qualifications to support the estimate. The format of the CE is shown in Exhibit D.

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3. Uses parametric methods of estimating for material and labor estimates; based on capacity, ratio methods and comparisons with similar type of projects. Material and labor costs should be adjusted to current day cost and existing conditions.
4. Uses estimating factors to obtain the most probable estimate for Equipment and Construction.
5. Accuracy of these estimates is +/- 30%.
6. Design Cost will be estimated at 12% of the Construction cost, unless otherwise justified.
7. FME Management will be estimated at 10% of the Design and Construction cost, unless otherwise justified. An increase or decrease adjustment to the FME Management jobhour estimate may be made based on the complexity and/or size of the work order.
8. Operations & Maintenance (O&M) total cost will be estimated at 5% of the Design and Construction cost, unless otherwise justified.
9. Construction Shop Support (Equipment Material & Supplies) for subcontracted work will be estimated at 5% of the Design and Construction cost, when applicable. A separate amount would need to be otherwise justified.
10. A Management Reserve of 30% of the total project cost, unless otherwise justified, will be included.
11. Conceptual Estimate is to be based on a square foot ratio method or historical comparisons with similar type work when possible.
12. A preliminary schedule or timeframe is necessary to bound the cost estimate for the work order. The level of detail for the schedule will be dependent on the complexity and/or cost of the work order. For the simplest of Work Orders this schedule/timeframe need only be one duration for the total effort.
13. The CE will be reviewed by the PM, the Manager of Operations & Maintenance, the Manager of Engineering, and the Project Controls Manager (or their designee) prior to submittal to the FME Director and the NCI. See Exhibit A for the estimating and approval process.

**(b) Preliminary Estimate (PE)**

1. An internal estimate is developed for large or complex jobs as determined by the PM or the Manager of Engineering after the design is approximately 15% complete.
2. The format of the Preliminary Estimate is shown in Exhibit E
3. Changes between the Conceptual and Preliminary Estimates will be communicated to the customer through the trend process. The project baseline will be updated as necessary for changes due to approved scope change trends.

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4. The Scope of Work (SOW) will be developed with input from the responsible Project Manager, Lead Engineer or Renovation Crew (RC) Lead, and the assigned project team personnel.
5. A detailed engineering job-hour forecast estimate will be developed in coordination with the engineering disciplines using the template shown in Exhibit G.
6. Material pricing will be from procurement, vendor quotes, FME historical experience, or commercially available sources.
7. The estimate should include a listing of assumptions and qualifications to support the estimate.
8. A Management Reserve of 20% of the total project cost, unless otherwise justified, will be included.
9. The Preliminary Estimate will be reviewed by the PM, the Manager of Engineering, and the Project Controls Manager (or their designee) prior to submittal to the FME Director. See Exhibit A for the estimating and approval process.

**(c) Fiscal Estimate (FE)**

1. A complete engineering and construction estimate is developed after Engineering design documents have been issued and the design is considered to be at the 95%-100% complete stage.
2. The Fiscal Approval (FA) is based on the detailed estimate that is developed from the completed design. The FA allows the commencement of construction. Final determination of the funding requirements will occur at the Fiscal Approval of the work order.
3. The format of the Fiscal Estimate is shown in Exhibit E
4. A shop estimate is developed for work that will be performed in-house by the FME support shops as opposed to construction work that is out-sourced to a outside subcontractor.
  - Typically smaller, less complex work orders are performed “in-house”
  - The shop foremen meet with the customer (when necessary via a shop walk-down) to define the scope of work to be performed.
  - Shop foreman develop labor and material cost estimates broken down in sufficient detail by various shops after the job walkdown. An FME estimator develops a means based estimate for more complex jobs after participating in the job walkdown.
  - A complete shop estimate is developed after the design is developed or the scope of work is defined by the customer.



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5. The baseline budget for the work order baseline is revised according to the approved scope change trends as documented within the Fiscal Estimate package in accordance with the Trend Procedure FMEP-G-0120.
6. All components of the estimate are in detail.
7. Quantities can be estimated from visual inspection from site walk downs or from drawing takeoffs.
8. Labor hours are estimated based on the assumed construction crew size.
9. Labor unit rates are based on site experience.
10. A Management Reserve of 10% of the total project cost, unless otherwise justified, will be included.
11. Material pricing will be from historical costs, or other pricing methods which can include previous procurement or vendor quotes.
12. The Detailed Estimate will be reviewed by the PM, the Manager of Operations & Maintenance, the Manager of Engineering, and the Project Controls Manager (or their designee) prior to submittal to the FME Director and the Directorate Customer. See Exhibit A for the estimating and approval process.

**(d) Trend Estimate**

1. Trend Estimates are prepared in accordance with FME Procedure FMEP-G-0120, and are used to support the Conceptual, Preliminary, and Fiscal Estimates.
2. Individual trends are reviewed with and approved by the Directorate Customer. Subsequently, any trends that are developed during the implementation of the work order will be incorporated into the Fiscal Estimates and COA packages for NCI's concurrence and approval.
3. Trend Estimates are by their nature ROM estimates in order to facilitate the decision making process as to whether to proceed or not with the trend.
4. Estimating factors will be considered and used to quickly develop the ROM estimate. The trend estimate will also be based on parametric methods when possible.
5. Schedule estimates should consider resource availability.
6. Trends need to be identified early.
7. Trend estimates ideally should be developed within two days of receiving the SOW from the PM.
8. A well-defined SOW is essential to support the trend estimate.
9. Trend Estimates will be reviewed by the PM prior to being incorporated into the database.

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(e) **Comparative Cost Estimates** are estimate evaluations by the estimator. Construction Contracts or the Project Manager uses this type of estimate to check and verify subcontractor proposed baseline pricing or change order requests.

(f) **Independent Cost Estimates (ICE)** are estimate evaluations by the estimator which are performed in parallel to another estimate by either the shops or outside subcontractors. The estimator will estimate from the same scope of work basis (eg. Site walk down or documented SOW) and will estimate from the quantity estimates developed by the shops or outside subcontractor. The ICE provides an independent assessment of the work estimate to provide a greater confidence for the cost estimate.

### 3.0 PROCEDURE

#### 3.1 Estimating Process

##### A. Conceptual Estimate (CE) Process (See Exhibit A)

1. The Work Order is received at FME for action.
2. The Work Order Coordination Committee screens the Work Order at the Work Order Review Meeting (WORM).
3. The Committee will designate the Project Manager.
4. The PM, or his designee, develops the scope of work.
5. For non-engineered jobs, the estimator develops the conceptual estimate with input from the PM.
6. The CE is routed for internal approval.
7. Submit the CE to NCI for approval.
8. Conceptual approval authorizes commencement of design.
9. Conceptual approval determines the "Go / No Go" status of the Work Order.

##### B. Preliminary Estimate (PE) Process (See Exhibit A)

1. Prepared when approximately 15% of design is completed for designated jobs
2. The PM, or his designee, updates the scope of work based on the 15% design
3. PM holds Kick-off meeting
4. PM with the engineering department developing the jobhour budget.
5. The Estimator and PM review trends and changes in the SOW from the CE to the PE at the 15% design stage.
6. If a contract modification is required (greater than \$5,000 or 10%) a COA will need to be obtained to proceed with work.
7. The Trend Engineer/Estimator develops the preliminary estimate with input from the PM
8. A trend is developed if necessary to identify any changes between the CE and PE and is routed for approval.

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C. Fiscal Estimate (See Exhibit A)

1. Prepared when the design is between 95% and 100% complete.
2. Engineering design documents are issued to the estimator for estimate.
3. Project trends are reviewed for incorporation
4. If a contract modification is required (greater than \$5,000 or 10%) a COA will need to be obtained to proceed with work.
5. If required, take-off of details are done by the estimator
6. Labor hours are developed in detail
7. Labor unit rates are reviewed for adjustments
8. Material pricing is reviewed for adjustments
9. The FE is routed for internal approval
10. Submit the FE to NCI for approval
11. The approval of the Detailed (Fiscal) Estimate allows the commencement of construction and revises the Work Order funding and baseline budget.

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FMEP-G-0130 Exhibits

Exhibit A – Estimating Process Flow Chart (4 pages)

Exhibit B – Estimate Classifications (2 pages)

Exhibit C – Standard Estimate Signature and Coversheet (1 page)

Exhibit D – Conceptual Estimate Forms (2 pages)

Exhibit E – Preliminary & Fiscal Estimate Forms (2 pages)

Exhibit F – Estimate Desktop Instructions (2 pages)

Exhibit G – Preliminary Estimate - Engineering Jobhour Forms (5 pages)

Exhibit H – Shop Detail Input forms (2 pages)